TPS650332-Q1 汽车摄像头 PMIC

1 特性

- 符合汽车应用要求
- 系统功能符合 ASIL D 和 SIL 3 要求
- 硬件完整性高达 ASIL B 和 SIL 2 级
- 高级诊断和保护
- 符合 AEC-Q100 1 级标准
  - –40°C 至 125°C 环境工作温度范围
- 三个降压转换器：
  - BUCK1 V_{IN} 范围为 4.0V 至 18.3V
  - BUCK1 V_{OUT} 范围为 2.5V 至 4.0V
  - BUCK1 输出电流高达 1500mA
  - BUCK2 和 BUCK3 V_{IN} 范围为 2.5 V 至 5.5V
  - BUCK2 和 BUCK3 V_{OUT} 范围为 0.9V 至 1.9V
  - BUCK2 and BUCK3 输出电流高达 1200mA
  - 用于降低 EMI 的扩频时钟 (SSC) 发生器
  - 2.3MHz 强制固定开关频率 PWM 模式工作
- 一个低压降 (LDO) 稳压器：
  - V_{IN} 范围为 2.5 V 至 5.5V
  - V_{OUT} 范围为 1.8V 至 3.3V
  - 低噪声和高 PSRR
  - 可通过 I^2C 调节的输出电压
  - 高达 300mA 的输出电流
- 具有可湿性侧面的 4.0mm × 4.0mm 24 引脚 VQFN 封装

2 应用

- 汽车摄像头模块
  - 环视摄像头模块
  - 后视摄像头模块
  - 驾驶员监控摄像头模块
  - 同轴电缆供电 (POC) 摄像头模块
  - 电子视镜摄像头模块
  - 前视摄像头模块

3 说明

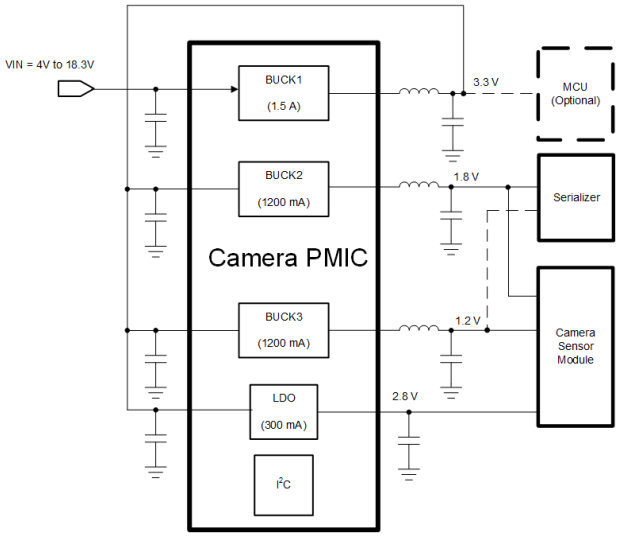
TPS650332-Q1 器件是一种高度集成的电源管理 IC，可适用于汽车摄像头模块。此器件包含三个降压转换器和一个低压降 (LDO) 稳压器。BUCK1 降压转换器的输入电压范围高达 18.3V，用于连接到同轴电缆 (PoC)。所有转换器都在强制固定频率 PWM 模式下工作。LDO 可提供 300mA 电流，并可在 2.5V 至 5.5V 的输入电压范围内正常运行。降压转换器和 LDO 具有独立的电压输入，可实现最大的设计和排序灵活性。

TPS650332-Q1 采用 24 引脚 VQFN 封装 (4.00mm × 4.00mm)。

器件信息

器件型号(1)	封装	封装尺寸（标称值）
TPS650332-Q1	VQFN (24)	4.00mm × 4.00mm

(1) 如需了解所有可用封装，请参阅数据表末尾的可订购产品附录。



TPS650332-Q1 应用电路

本文档旨在为方便起见，提供有关 TI 产品中文版本的信息，以确认产品的概要。有关适用的官方英文版本的最新信息，请访问 www.ti.com，其内容始终优先。TI 不保证翻译的准确性和有效性。在实际设计之前，请务必参考最新版本的英文版本。

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4 Revision History

注：以前版本的页码可能与当前版本的页码不同

DATE	REVISION	NOTES
September 2023	*	Initial Release

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5 Device and Documentation Support

5.1 Device Support

5.1.1 第三方产品免责声明

TI 发布的与第三方产品或服务有关的信息，不能构成与此类产品或服务或保修的适用性有关的认可，不能构成此类产品或服务单独或与任何 TI 产品或服务一起的表示或认可。

5.2 接收文档更新通知

要接收文档更新通知，请导航至 ti.com 上的器件产品文件夹。点击 *订阅更新* 进行注册，即可每周接收产品信息更改摘要。有关更改的详细信息，请查看任何已修订文档中包含的修订历史记录。

5.3 支持资源

TI E2E™ 支持论坛是工程师的重要参考资料，可直接从专家获得快速、经过验证的解答和设计帮助。搜索现有解答或提出自己的问题可获得所需的快速设计帮助。

链接的内容由各个贡献者“按原样”提供。这些内容并不构成 TI 技术规范，并且不一定反映 TI 的观点；请参阅 TI 的《使用条款》。

5.4 Trademarks

TI E2E™ is a trademark of Texas Instruments.
所有商标均为其各自所有者的财产。

5.5 静电放电警告

静电放电 (ESD) 会损坏这个集成电路。德州仪器 (TI) 建议通过适当的预防措施处理所有集成电路。如果不遵守正确的处理和安装程序，可能会损坏集成电路。

ESD 的损坏小至导致微小的性能降级，大至整个器件故障。精密的集成电路可能更容易受到损坏，这是因为非常细微的参数更改都可能会导致器件与其发布的规格不相符。

5.6 术语表

TI 术语表	本术语表列出并解释了术语、首字母缩略词和定义。

6 Mechanical, Packaging, and Orderable Information

The following pages include mechanical, packaging, and orderable information. This information is the most current data available for the designated devices. This data is subject to change without notice and revision of this document. For browser-based versions of this data sheet, refer to the left-hand navigation.

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PACKAGING INFORMATION

Orderable part number	Status (1)	Material type (2)	Package | Pins	Package qty | Carrier	RoHS (3)	Lead finish/ Ball material (4)	MSL rating/ Peak reflow (5)	Op temp (°C)	Part marking (6)
TPS65033200RGERQ1	Active	Production	VQFN (RGE) | 24	3000 | LARGE T&R	Yes	NIPDAU | SN	Level-3-260C-168 HR	-40 to 125	TPS6503 XXXX-Q1
TPS65033200RGERQ1.A	Active	Production	VQFN (RGE) | 24	3000 | LARGE T&R	Yes	NIPDAU	Level-3-260C-168 HR	-40 to 125	TPS6503 XXXX-Q1
TPS65033201RGERQ1	Active	Production	VQFN (RGE) | 24	3000 | LARGE T&R	Yes	NIPDAU | SN	Level-3-260C-168 HR	-40 to 125	TPS6503 3201-Q1
TPS65033201RGERQ1.A	Active	Production	VQFN (RGE) | 24	3000 | LARGE T&R	Yes	NIPDAU	Level-3-260C-168 HR	-40 to 125	TPS6503 3201-Q1
TPS65033203RGERQ1	Active	Production	VQFN (RGE) | 24	3000 | LARGE T&R	Yes	NIPDAU | SN	Level-3-260C-168 HR	-40 to 125	TPS6503 3203-Q1
TPS65033203RGERQ1.A	Active	Production	VQFN (RGE) | 24	3000 | LARGE T&R	Yes	NIPDAU	Level-3-260C-168 HR	-40 to 125	TPS6503 3203-Q1
TPS65033205QRGERQ1	Active	Production	VQFN (RGE) | 24	3000 | LARGE T&R	Yes	Call TI | Nipdau	Level-3-260C-168 HR	-40 to 125	TPS6503 3205-Q1
TPS65033205QRGERQ1.A	Active	Production	VQFN (RGE) | 24	3000 | LARGE T&R	Yes	NIPDAU	Level-3-260C-168 HR	-40 to 125	TPS6503 3205-Q1
TPS65033206RGERQ1	Active	Production	VQFN (RGE) | 24	3000 | LARGE T&R	Yes	NIPDAU | SN	Level-3-260C-168 HR	-40 to 125	TPS6503 3206-Q1
TPS65033206RGERQ1.A	Active	Production	VQFN (RGE) | 24	3000 | LARGE T&R	Yes	NIPDAU	Level-3-260C-168 HR	-40 to 125	TPS6503 3206-Q1
TPS65033207RGERQ1	Active	Production	VQFN (RGE) | 24	3000 | LARGE T&R	Yes	NIPDAU | SN	Level-3-260C-168 HR	-40 to 125	TPS6503 3207-Q1
TPS65033207RGERQ1.A	Active	Production	VQFN (RGE) | 24	3000 | LARGE T&R	Yes	NIPDAU	Level-3-260C-168 HR	-40 to 125	TPS6503 3207-Q1
TPS65033208CRGERQ1	Active	Production	VQFN (RGE) | 24	3000 | LARGE T&R	Yes	NIPDAU	Level-3-260C-168 HR	-40 to 125	TPS6503 3208CQ1
TPS65033208CRGERQ1.A	Active	Production	VQFN (RGE) | 24	3000 | LARGE T&R	Yes	NIPDAU	Level-3-260C-168 HR	-40 to 125	TPS6503 3208CQ1
TPS65033208RGERQ1	Active	Production	VQFN (RGE) | 24	3000 | LARGE T&R	Yes	Call TI | Nipdau	Level-3-260C-168 HR	-40 to 125	TPS6503 3208-Q1
TPS65033208RGERQ1.A	Active	Production	VQFN (RGE) | 24	3000 | LARGE T&R	Yes	NIPDAU	Level-3-260C-168 HR	-40 to 125	TPS6503 3208-Q1

Orderable part number	Status (1)	Material type (2)	Package | Pins	Package qty | Carrier	RoHS (3)	Lead finish/ Ball material (4)	MSL rating/ Peak reflow (5)	Op temp (°C)	Part marking (6)
TPS65033209QRGERQ1	Active	Production	VQFN (RGE) | 24	3000 | LARGE T&R	Yes	NIPDAU | SN	Level-3-260C-168 HR	-40 to 125	TPS6503 3209-Q1
TPS65033209QRGERQ1.A	Active	Production	VQFN (RGE) | 24	3000 | LARGE T&R	Yes	NIPDAU	Level-3-260C-168 HR	-40 to 125	TPS6503 3209-Q1
TPS6503320AARGERQ1	Active	Production	VQFN (RGE) | 24	3000 | LARGE T&R	Yes	NIPDAU | SN	Level-3-260C-168 HR	-40 to 125	TPS6503 320AAQ1
TPS6503320AARGERQ1.A	Active	Production	VQFN (RGE) | 24	3000 | LARGE T&R	Yes	NIPDAU	Level-3-260C-168 HR	-40 to 125	TPS6503 320AAQ1
TPS6503320CCRGERQ1	Active	Production	VQFN (RGE) | 24	3000 | LARGE T&R	Yes	NIPDAU	Level-3-260C-168 HR	-40 to 125	TPS6503 320CCQ1
TPS6503320CCRGERQ1.A	Active	Production	VQFN (RGE) | 24	3000 | LARGE T&R	Yes	NIPDAU	Level-3-260C-168 HR	-40 to 125	TPS6503 320CCQ1
TPS6503320CRGERQ1	Active	Production	VQFN (RGE) | 24	3000 | LARGE T&R	Yes	SN	Level-3-260C-168 HR	-40 to 125	TPS6503 320C-Q1
TPS6503320CRGERQ1.A	Active	Production	VQFN (RGE) | 24	3000 | LARGE T&R	Yes	SN	Level-3-260C-168 HR	-40 to 125	TPS6503 320C-Q1
TPS6503320DCRGERQ1	Active	Production	VQFN (RGE) | 24	3000 | LARGE T&R	Yes	NIPDAU	Level-3-260C-168 HR	-40 to 125	TPS6503 320DCQ1
TPS6503320DCRGERQ1.A	Active	Production	VQFN (RGE) | 24	3000 | LARGE T&R	Yes	NIPDAU	Level-3-260C-168 HR	-40 to 125	TPS6503 320DCQ1
TPS6503320DRGERQ1	Active	Production	VQFN (RGE) | 24	3000 | LARGE T&R	Yes	NIPDAU | SN	Level-3-260C-168 HR	-40 to 125	TPS6503 320D-Q1
TPS6503320DRGERQ1.A	Active	Production	VQFN (RGE) | 24	3000 | LARGE T&R	Yes	NIPDAU	Level-3-260C-168 HR	-40 to 125	TPS6503 320D-Q1
TPS6503320FCRGERQ1	Active	Production	VQFN (RGE) | 24	3000 | LARGE T&R	Yes	NIPDAU	Level-3-260C-168 HR	-40 to 125	TPS6503 320FCQ1
TPS6503320FCRGERQ1.A	Active	Production	VQFN (RGE) | 24	3000 | LARGE T&R	Yes	NIPDAU	Level-3-260C-168 HR	-40 to 125	TPS6503 320FCQ1
TPS6503320FRGERQ1	Active	Production	VQFN (RGE) | 24	3000 | LARGE T&R	Yes	Call TI | Nipdau	Level-3-260C-168 HR	-40 to 125	TPS6503 320F-Q1
TPS6503320FRGERQ1.A	Active	Production	VQFN (RGE) | 24	3000 | LARGE T&R	Yes	NIPDAU	Level-3-260C-168 HR	-40 to 125	TPS6503 320F-Q1
TPS6503320GRGERQ1	Active	Production	VQFN (RGE) | 24	3000 | LARGE T&R	Yes	NIPDAU | SN	Level-3-260C-168 HR	-40 to 125	TPS6503 320G-Q1

Orderable part number	Status (1)	Material type (2)	Package | Pins	Package qty | Carrier	RoHS (3)	Lead finish/ Ball material (4)	MSL rating/ Peak reflow (5)	Op temp (°C)	Part marking (6)
TPS6503320GRGERQ1.A	Active	Production	VQFN (RGE) | 24	3000 | LARGE T&R	Yes	NIPDAU	Level-3-260C-168 HR	-40 to 125	TPS6503 320G-Q1
TPS6503320HARGERQ1	Active	Production	VQFN (RGE) | 24	3000 | LARGE T&R	Yes	NIPDAU | SN	Level-3-260C-168 HR	-40 to 125	TPS6503 320HAQ1
TPS6503320HARGERQ1.A	Active	Production	VQFN (RGE) | 24	3000 | LARGE T&R	Yes	NIPDAU	Level-3-260C-168 HR	-40 to 125	TPS6503 320HAQ1
TPS6503320KRGERQ1	Active	Production	VQFN (RGE) | 24	3000 | LARGE T&R	Yes	NIPDAU | SN	Level-3-260C-168 HR	-40 to 125	TPS6503 320K-Q1
TPS6503320KRGERQ1.A	Active	Production	VQFN (RGE) | 24	3000 | LARGE T&R	Yes	NIPDAU	Level-3-260C-168 HR	-40 to 125	TPS6503 320K-Q1
TPS6503320MRGERQ1	Active	Production	VQFN (RGE) | 24	3000 | LARGE T&R	Yes	NIPDAU | SN	Level-3-260C-168 HR	-40 to 125	TPS6503 320M-Q1
TPS6503320MRGERQ1.A	Active	Production	VQFN (RGE) | 24	3000 | LARGE T&R	Yes	NIPDAU	Level-3-260C-168 HR	-40 to 125	TPS6503 320M-Q1
TPS6503320NCRGERQ1	Active	Production	VQFN (RGE) | 24	3000 | LARGE T&R	Yes	NIPDAU	Level-3-260C-168 HR	-40 to 125	TPS6503 320NCQ1
TPS6503320NCRGERQ1.A	Active	Production	VQFN (RGE) | 24	3000 | LARGE T&R	Yes	NIPDAU	Level-3-260C-168 HR	-40 to 125	TPS6503 320NCQ1
TPS6503320NRGERQ1	Active	Production	VQFN (RGE) | 24	3000 | LARGE T&R	Yes	NIPDAU | SN	Level-3-260C-168 HR	-40 to 125	TPS6503 320N-Q1
TPS6503320NRGERQ1.A	Active	Production	VQFN (RGE) | 24	3000 | LARGE T&R	Yes	NIPDAU	Level-3-260C-168 HR	-40 to 125	TPS6503 320N-Q1
TPS6503320PRGERQ1	Active	Production	VQFN (RGE) | 24	3000 | LARGE T&R	Yes	NIPDAU | SN	Level-3-260C-168 HR	-40 to 125	TPS6503 320P-Q1
TPS6503320PRGERQ1.A	Active	Production	VQFN (RGE) | 24	3000 | LARGE T&R	Yes	NIPDAU	Level-3-260C-168 HR	-40 to 125	TPS6503 320P-Q1
TPS65033218CRGERQ1	Active	Production	VQFN (RGE) | 24	3000 | LARGE T&R	Yes	NIPDAU	Level-3-260C-168 HR	-40 to 125	TPS6503 3218CQ1
TPS6503321MCRGERQ1	Active	Production	VQFN (RGE) | 24	3000 | LARGE T&R	Yes	NIPDAU	Level-3-260C-168 HR	-40 to 125	TPS6503 321MCQ1
TPS6503321MCRGERQ1.A	Active	Production	VQFN (RGE) | 24	3000 | LARGE T&R	Yes	NIPDAU	Level-3-260C-168 HR	-40 to 125	TPS6503 321MCQ1

(1) **Status:** For more details on status, see our product life cycle.

(2) **Material type:** When designated, preproduction parts are prototypes/experimental devices, and are not yet approved or released for full production. Testing and final process, including without limitation quality assurance, reliability performance testing, and/or process qualification, may not yet be complete, and this item is subject to further changes or possible discontinuation. If available for ordering, purchases will be subject to an additional waiver at checkout, and are intended for early internal evaluation purposes only. These items are sold without warranties of any kind.

(3) **RoHS values:** Yes, No, RoHS Exempt. See the TI RoHS Statement for additional information and value definition.

(4) **Lead finish/Ball material:** Parts may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

(5) **MSL rating/Peak reflow:** The moisture sensitivity level ratings and peak solder (reflow) temperatures. In the event that a part has multiple moisture sensitivity ratings, only the lowest level per JEDEC standards is shown. Refer to the shipping label for the actual reflow temperature that will be used to mount the part to the printed circuit board.

(6) **Part marking:** There may be an additional marking, which relates to the logo, the lot trace code information, or the environmental category of the part.

Multiple part markings will be inside parentheses. Only one part marking contained in parentheses and separated by a "~" will appear on a part. If a line is indented then it is a continuation of the previous line and the two combined represent the entire part marking for that device.

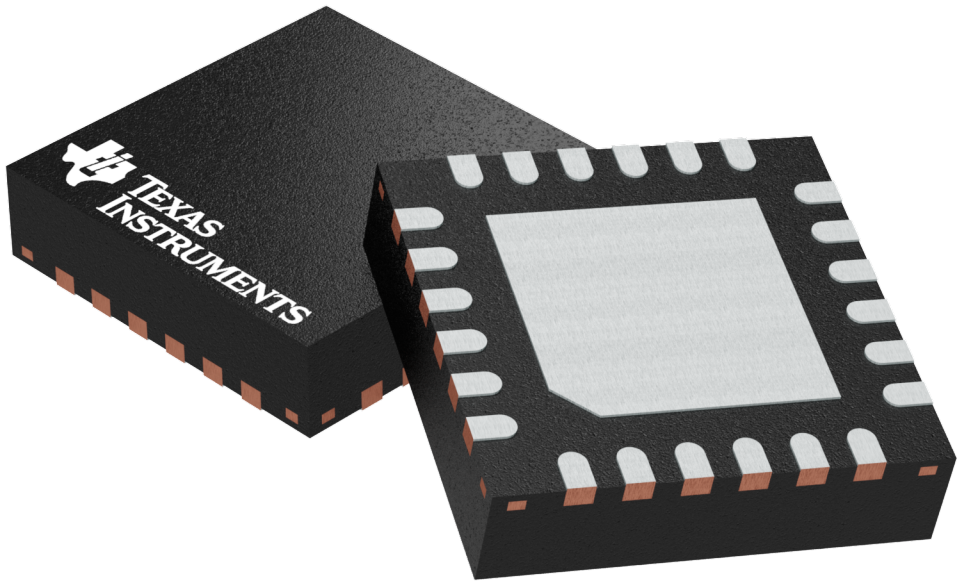
Important Information and Disclaimer: The information provided on this page represents TI's knowledge and belief as of the date that it is provided. TI bases its knowledge and belief on information provided by third parties, and makes no representation or warranty as to the accuracy of such information. Efforts are underway to better integrate information from third parties. TI has taken and continues to take reasonable steps to provide representative and accurate information but may not have conducted destructive testing or chemical analysis on incoming materials and chemicals. TI and TI suppliers consider certain information to be proprietary, and thus CAS numbers and other limited information may not be available for release.

In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

GENERIC PACKAGE VIEW

RGE 24 VQFN - 1 mm max height

PLASTIC QUAD FLATPACK - NO LEAD



Images above are just a representation of the package family, actual package may vary.
Refer to the product data sheet for package details.

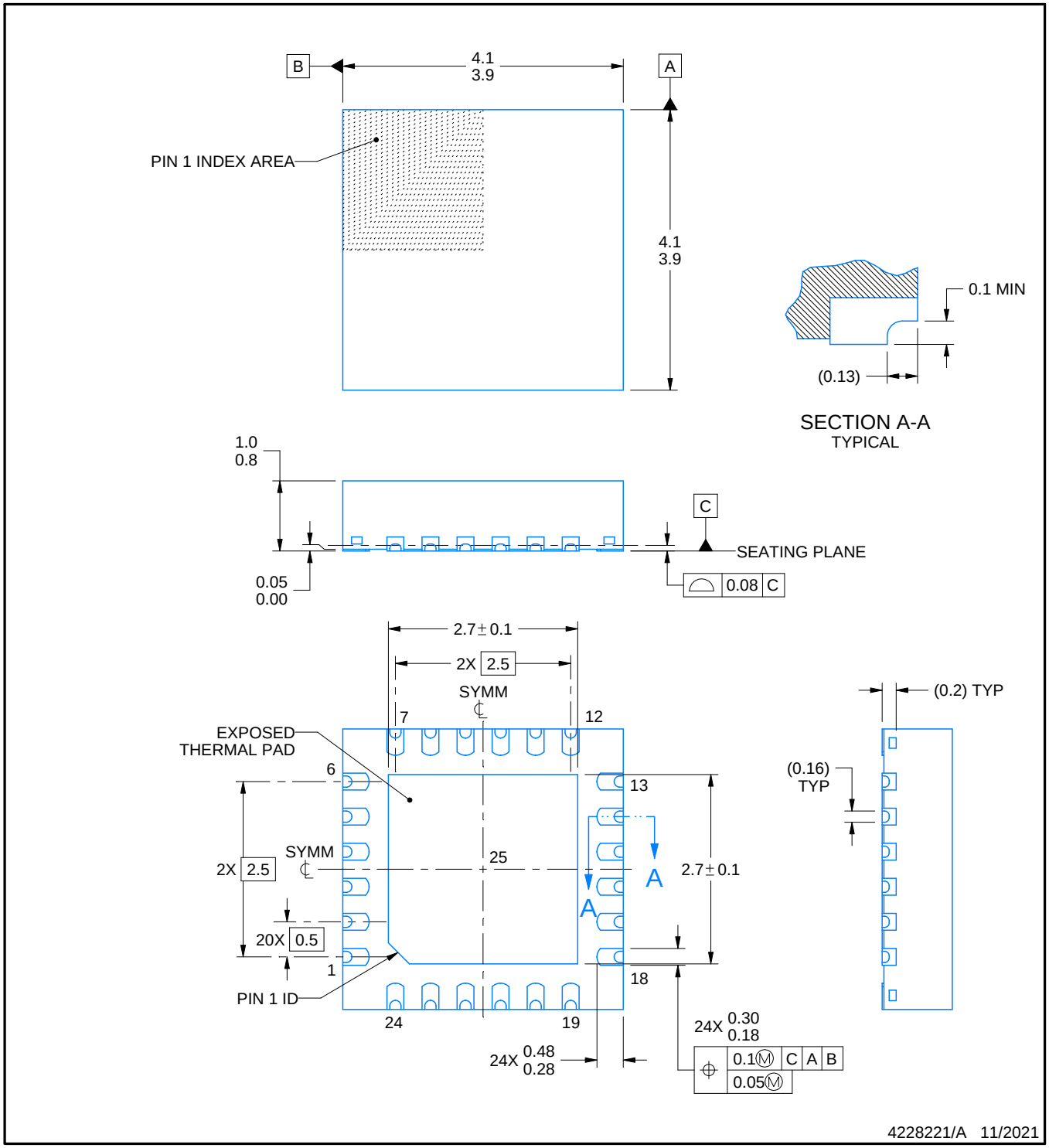
4204104/H

RGE0024U

PACKAGE OUTLINE

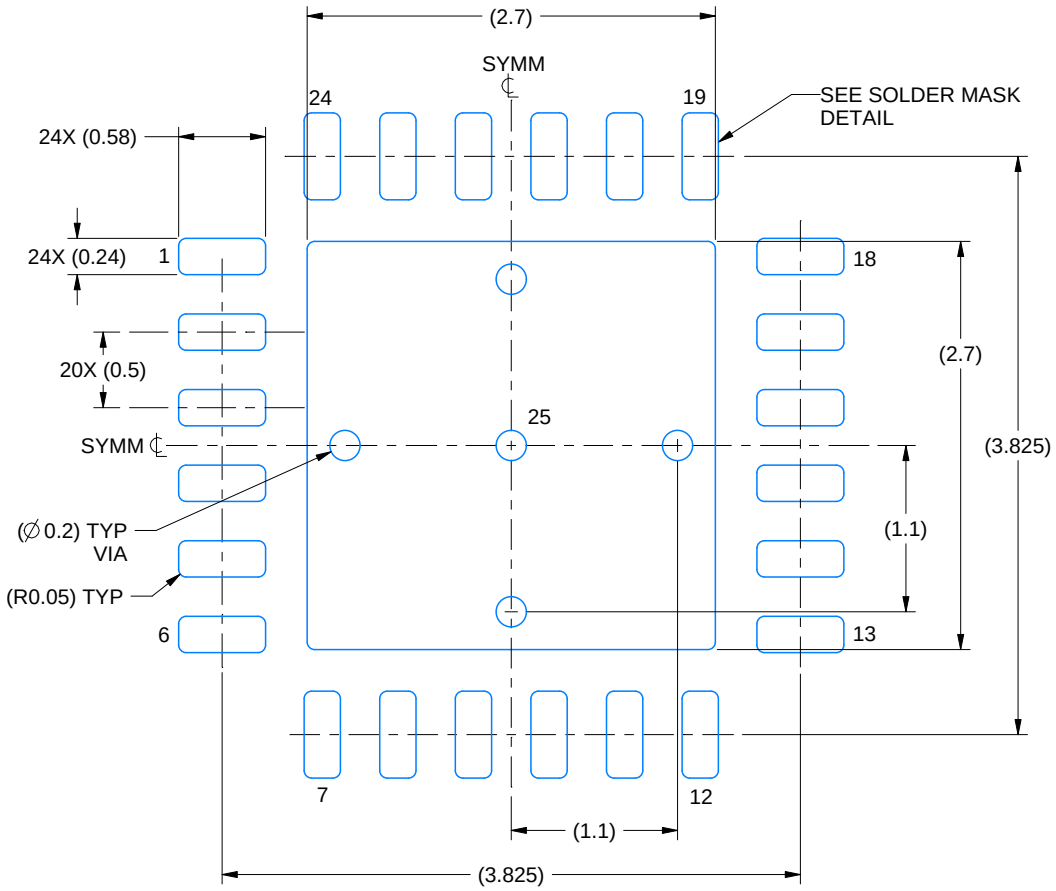
VQFN - 1 mm max height

PLASTIC QUAD FLATPACK - NO LEAD

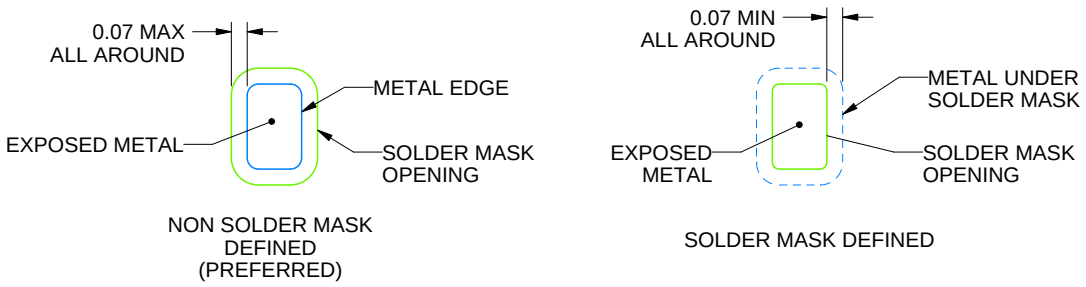


NOTES:

1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. The package thermal pad must be soldered to the printed circuit board for thermal and mechanical performance.



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE: 20X

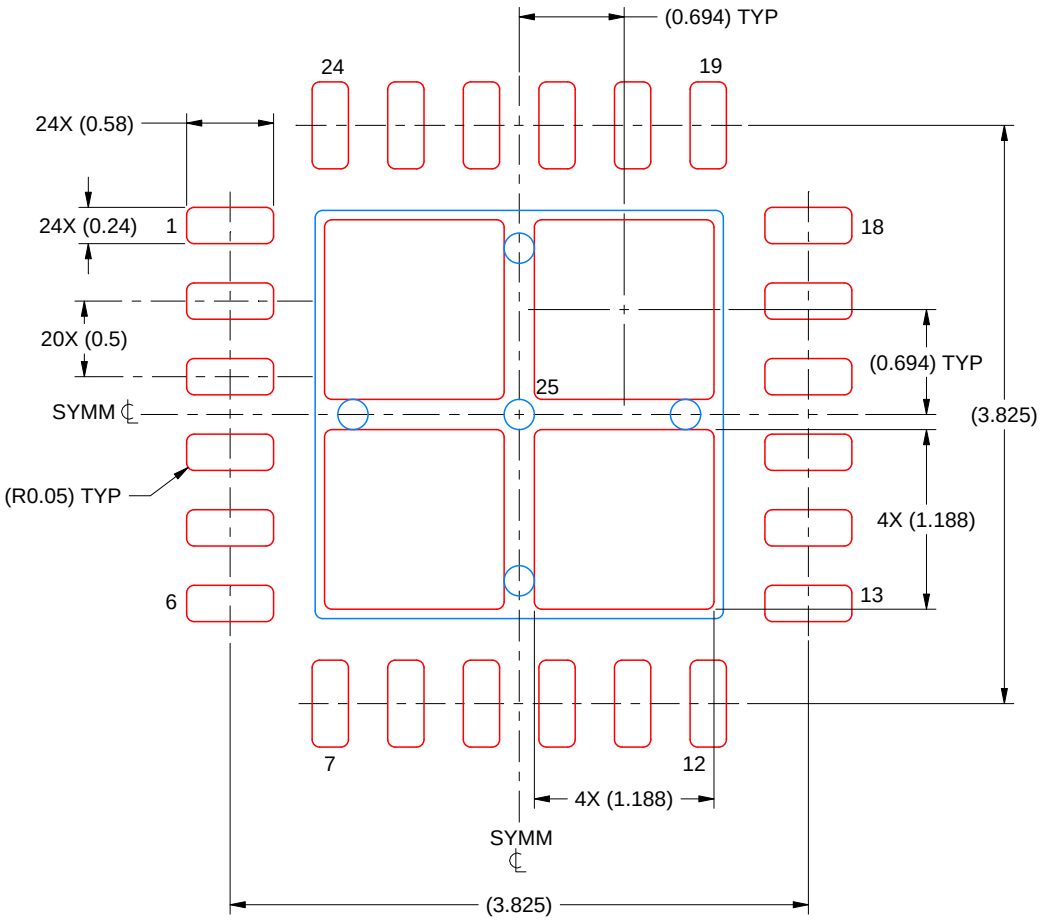


SOLDER MASK DETAILS

4228221/A 11/2021

NOTES: (continued)

4. This package is designed to be soldered to a thermal pad on the board. For more information, see Texas Instruments literature number SLUA271 (www.ti.com/lit/slua271).
5. Vias are optional depending on application, refer to device data sheet. If any vias are implemented, refer to their locations shown on this view. It is recommended that vias under paste be filled, plugged or tented.



SOLDER PASTE EXAMPLE
BASED ON 0.125 MM THICK STENCIL
SCALE: 20X

EXPOSED PAD 25
77% PRINTED SOLDER COVERAGE BY AREA UNDER PACKAGE

4228221/A 11/2021

NOTES: (continued)

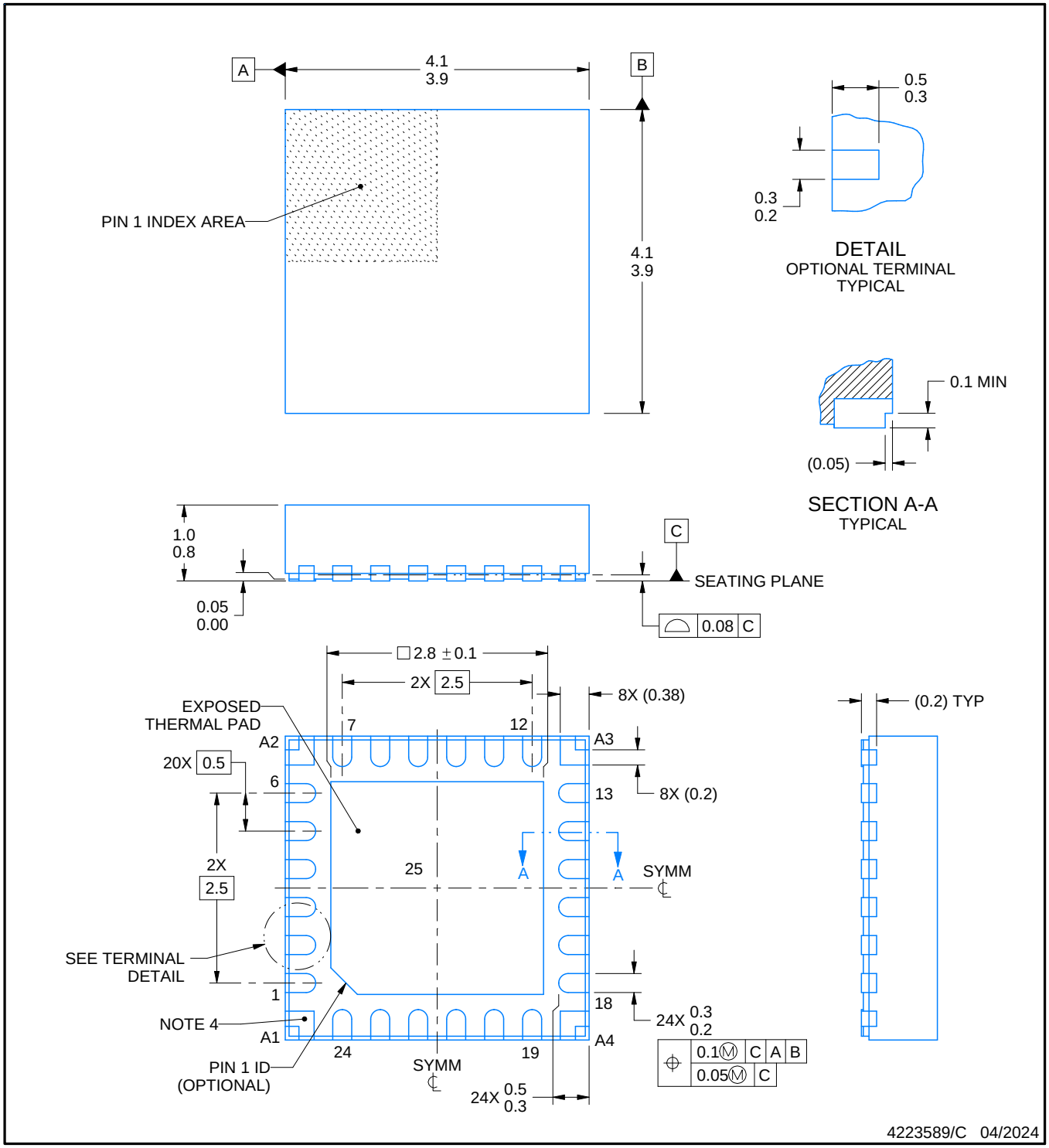
6. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.

PACKAGE OUTLINE

RGE0024K

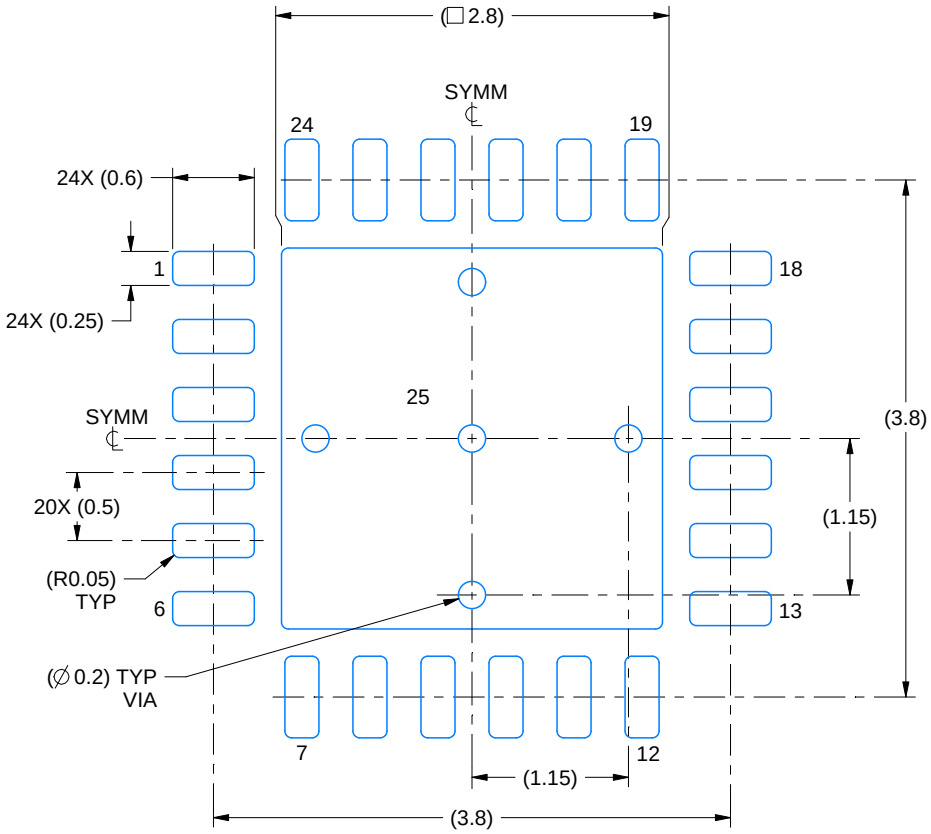
VQFN - 1 mm max height

PLASTIC QUAD FLATPACK - NO LEAD

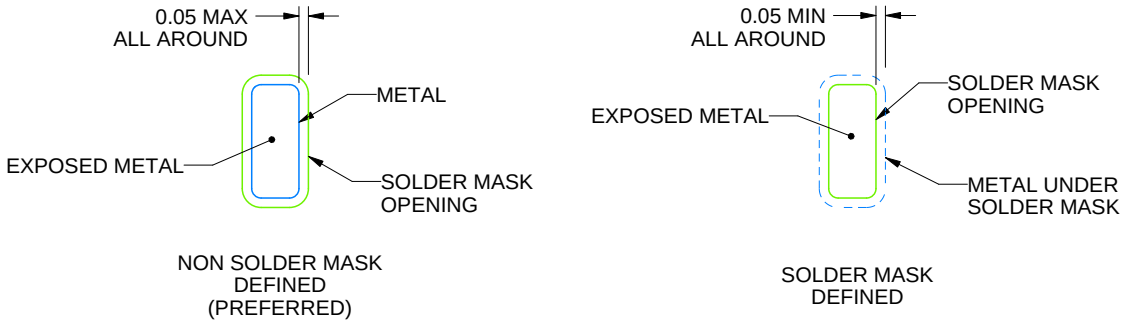


NOTES:

1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. The package thermal pad must be soldered to the printed circuit board for thermal and mechanical performance.
4. Corner pins A1-A4 are physically connected to exposed thermal pad internally. Soldering these is optional, but would require customer to supply land design and stencil.



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE:18X

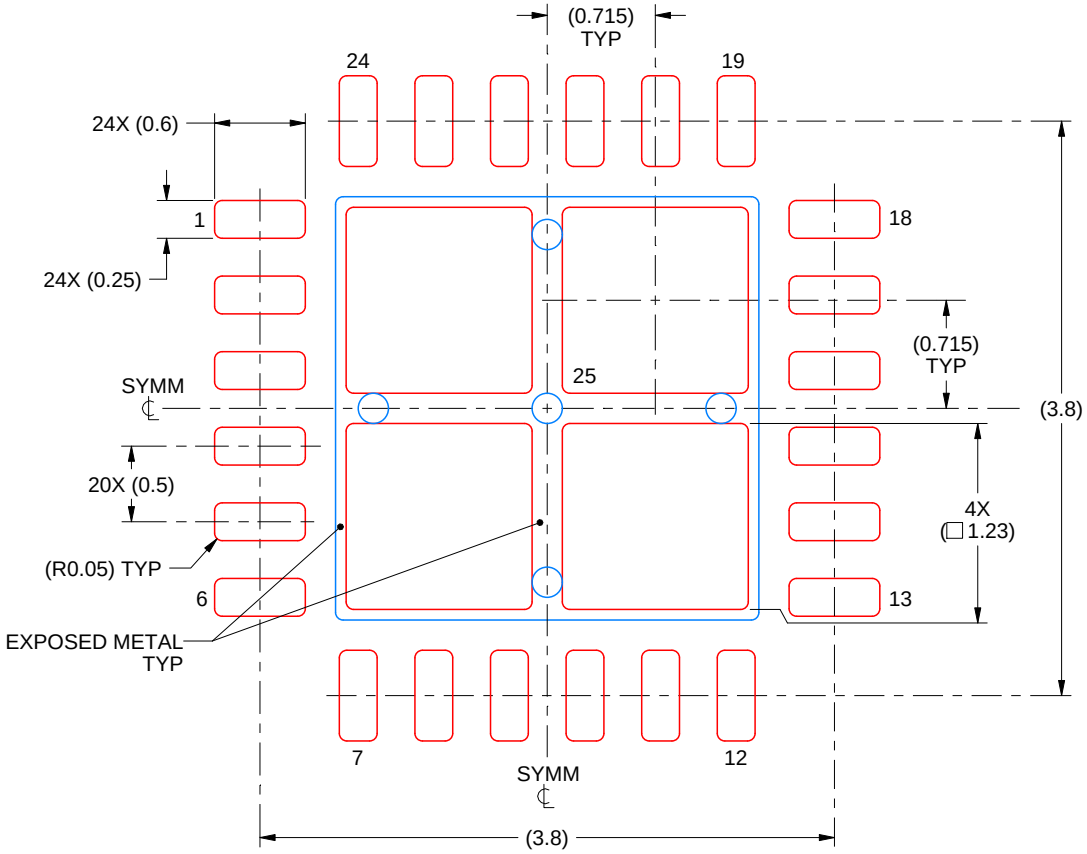


SOLDER MASK DETAILS

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NOTES: (continued)

5. This package is designed to be soldered to a thermal pad on the board. For more information, see Texas Instruments literature number SLUA271 (www.ti.com/lit/slua271).
6. Vias are optional depending on application, refer to device data sheet. If any vias are implemented, refer to their locations shown on this view. It is recommended that vias under paste be filled, plugged or tented.



SOLDER PASTE EXAMPLE
BASED ON 0.1 mm THICK STENCIL

THERMAL PAD 25:
77% PRINTED SOLDER COVERAGE BY AREA UNDER PACKAGE
SCALE:20X

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NOTES: (continued)

7. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.

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